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Geo-Location Based Information Retrieval System for Mobile Devices in Multiple Modes

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Abstract
The basic idea behind Geo-Location Based Information Retrieval System for Mobile Devices in Multiple Modes is to provide vibrant location-based service. Increasing the information retrieval accuracy especially in the limited mobile screen has become the important research areas in the development of mobile location-based services. In this paper, we propose a novel mobile information retrieval system based on GPS and Reverse Geo-Coding, kXML Parsing technique with Web2.0 applications. GPS determines the device's position by calculating the difference in time signals from different satellites take to reach the receiver. Considering different service requirements, this paper firstly proposes multiple information retrieval modes as Fuzzy Constraint Keywords based Searching Mode, Location-based Geo-Map Browsing Mode, 3-D Tag-Cloud based Collaborative Sharing Mode, which can enable the user to choose suitable retrieval mode and find the useful entity information quickly. The basic approach for implementing location-based services is obtaining location data for a device-based application that uses it directly. The primary service provided by this system is, it provides the location information such as latitude and longitudes values along with relative location name, city and country information.

Keywords
GPS, kXML Parsing, Reverse Geo-Coding, Fuzzy Constraint, Geo-Map Browsing, 3-D Tag-Cloud, Portability, Mobility

I. Introduction

A Location-Based Service (LBS) is an information service, which is reachable with mobile devices through the service providers and which uses information on the geographical position of the mobile device. Location-Based Services (LBS) can be used in a variety of contexts, such as work, personal life, entertainment, health, location history, RSS Feeds from web and indoor object search etc [2].

Today's mobile devices, be the tablets or smart phones such as i-Pod, are all equipped with GPS. Meaning the current location of a mobile user can be tracked. It has created location based services frenzy. Highly publicized in the media, and well funded; a new wave of companies are appearing. Now a days with the fast expansion and extensive deployment of information and telecommunication technologies incorporated with lightweight mobile devices and terminals, pinpointing location on the move has become a common exercise [1]. The technologies involve Geographical Information Systems (GIS), Global Positioning Systems (GPS) [3], radio frequency identification, and various other location sensing technologies with varying degrees of accuracy, coverage and cost of installation and maintenance. Some most recent location sensing technology based on ultra wideband radio can even achieve accuracies on the order of centimeters in an indoor environment [3].

A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include:

1. The time the message was transmitted
2. Precise orbital information (the ephemeris)
3. The general system health and rough orbits of all GPS satellites (the almanac).

II. Location Based Services

Location-Based Services (LBS) provide users of mobile devices personalized services tailored to their current location. They open a new market for developers, cellular network operators, and service providers to develop and deploy value-added services: advising users of current traffic conditions, supplying routing information, helping them find nearby restaurants and many more [4].

Location-based services answer three questions:

1. Where am I?
2. What's around me?
3. How do I get there?

They determine the position of the client/user by using one of numerous technologies for determining position, and then use the location and other information to provide personalized applications and services [1].

Location-based services is an integration of different kind of platforms and technologies, typically they are shown in the fig. 1. Here GIS (Global Information System) and Spatial Databases are commonly integrated major resources to our system, and Internet plays a major role in the system, because the information extraction will be done through the Internet services, the core part of this system depends on integration of these three platforms [7].

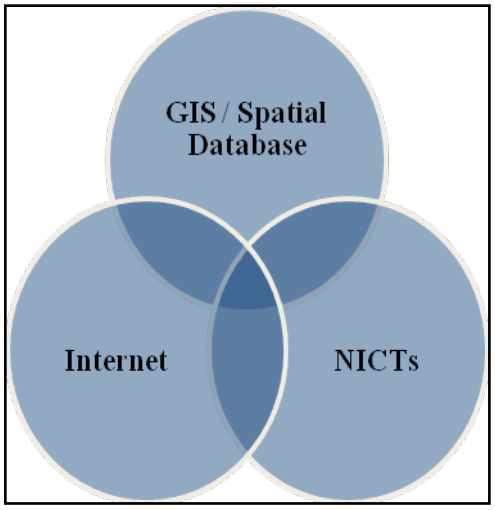

Fig. 1: Typical Integrated Structure of LBS

There are two basic approaches to implementing location-based services: 1. Process location data in a server and deliver results to the device, 2. Obtain location data for a device-based application that uses it directly.

III. Determining the Device's Location

There are three fundamental methods that are available to determine the current user location: In this paper we are presenting three conventional methods, among three first one is inexpensive, because the location information source will be generated with the help of network service provider.

A. Using the Mobile Phone Network

A network service provider has numerous hundred radio base stations (cells) that construct its network. Each base station is treated as a "cell" which covers a physical area and these cells connect mutually to build up the entire network. Cell sizes can vary from 100m in cities to 3K in rural areas. The current cell ID can be used to identify the Base Transceiver Station (BTS) that the device is communicating with and the location of that BTS. Other techniques used along with cell ID can achieve accuracy within 150 meters.

B. Using Satellites

Each GPS satellite broadcasts a high power, narrow bandwidth, downlink signal that may be received on your small hand held receiver antenna. The Global Positioning System (GPS), controlled by the US Department of Defense, uses a constellation of 24 satellites orbiting the earth(Shown in fig. 2). The GPS receiver obtains signals concurrently from all the visible satellites. GPS determines the device's location by calculating differences in the times signals from different satellites take to reach the receiver. The downlink frequency is in L band at 1575.42 MHz and comprises a signal intended for public use called the coarse/acquisition code or C/A-code. The Band mode, Frequency information is shown on Table 1. There are totally 5 different types of Bands available, each having different frequencies, based on these frequencies they are used in different applications.

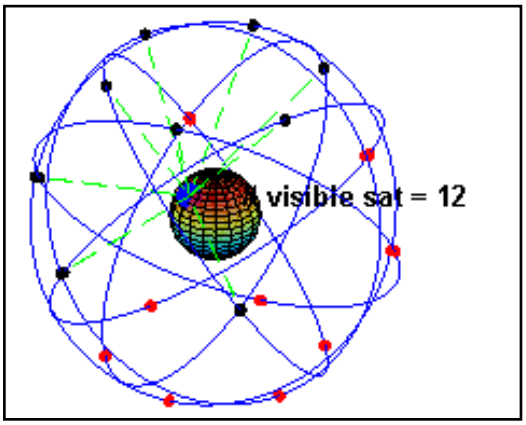

Fig. 2: GPS Constellation in Motion with Earth Rotating

Table1: Band-Downlink Frequency Information

Band	Frequency	Description
L1	1575.42 MHz	Coarse-acquisition (C/A) and encrypted precision P(Y) codes, plus the L1 civilian (L1C) and military (M) codes on future Block III satellites.
L2	1227.60 MHz	P(Y) code, plus the L2C and military codes on the Block IIR-M and newer satellites.
L3	1381.05 MHz	Used for nuclear detonation (NUDET) detection.
L4	1379.913 MHz	Being studied for additional ionospheric correction.
L5	1176.45 MHz	Proposed for use as a civilian safety-of-life (SoL) signal.

C. Using Short-Range Positioning Beacons

In relatively these are applicable to tiny areas, such as single constructions, a local area network can provide locations along with other services? For example, appropriately equipped devices can use Bluetooth for short-range positioning [5].

IV. Information Retrieval System Implementation Structure

A. Finding Geographical Position

To find the geographical location of mobile device, we used a technique called reverse geo-coding. Geo-coding is the process of converting addresses (like "tanuku,IN") into geographic coordinates (like latitude 16.749531 and longitude 81.695007), which you can use to place markers or position the map. The term geo-coding generally refers to translating a human-readable address into a location on a map. The process of doing the converse, translating a location on the map into a human-readable address, is known as reverse geo-coding.

Example:

http://www.orangeapplabs.com/geocode/create api.php?g=16.752934,81.694679

Is translated into "Rastrapathi Road (R.P Road), Tanuku, Andhra Pradesh, India".

This is readable to the human beings. For this reverse geo-coding, we are maintaining our own SQL Lite Database which is obtained from the Google Database. The entire process is shown in fig. 3. The fig. 4, shows the actual executable output.

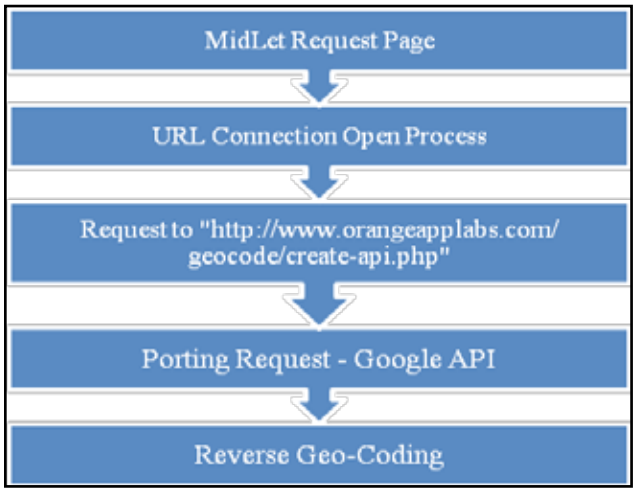

Fig. 3: Request Flow of Geo Location Finding Process

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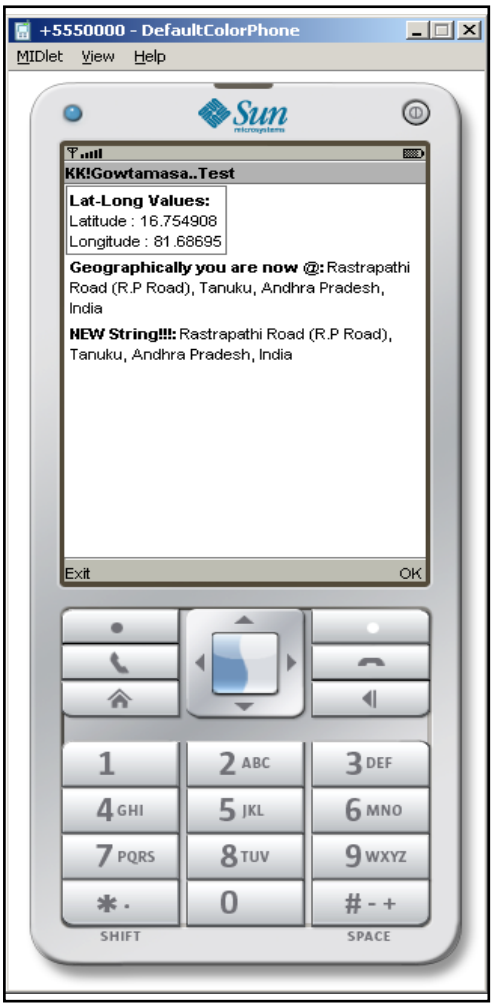

Fig. 4: Finding Current Location

Fig. 5: Finding Current Location

B. Extracting Location Map Information

In the process of developing Map application, J2ME developer can use Google Map API. Using this Google Static Map user can get back images in response to an HTTP connection via URL. For each request, you can specify the location of the map, the size of the image, the zoom level, the type of map, and the placement of optional markers at locations on the map. You can additionally label your markers using alphanumeric characters, so that you can refer to them in a "key"[6]. This Google Map APIs allows calculating directions between locations using an HTTP request. Directions may specify origins, destinations and waypoints either as text strings or latitude/longitude coordinates. To develop Maps service, J2ME developer can use Google Map API. Using this Google Map user can get images in response to an HTTP connection via URL. For each request, you can specify the location of the map, the width, height of the image, the zoom level, the kind of map, and the position of optional markers at locations on the map. You can additionally label your markers using alphanumeric characters, so that you can refer to them in a "key." This Google Map APIs allows calculating directions between locations using an HTTP request. Directions may specify origins, destinations and waypoints either as text strings or latitude/longitude coordinates. Fig. 4, shows real-time executable output for mobile devices.

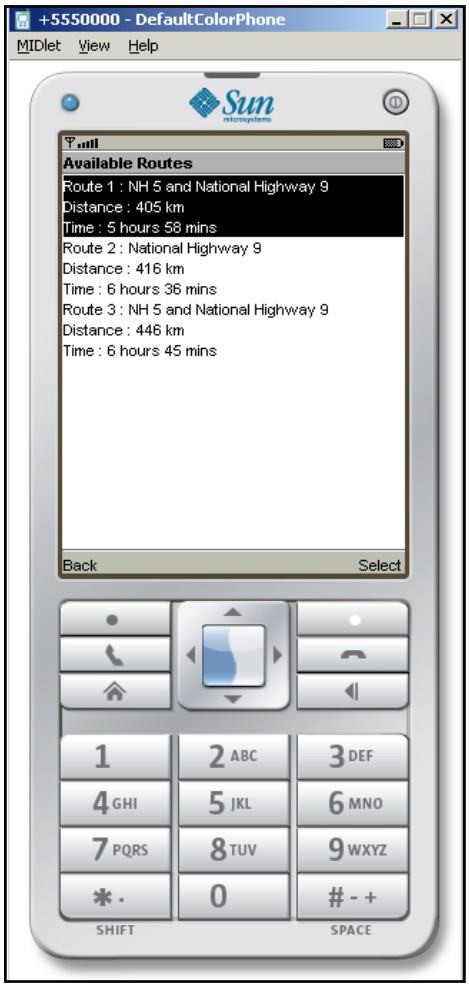

Fig. 6:

C. Obtaining Information from Web

To get the current location, historical background of location, today's weathers report, current news and other business information etc. we need to use XML parsing techniques, but the convention method of XML parsing was not possible in mobile device, because of constrained properties of deice size and screen space, so we have to take the support of kXML. kXML is a lightweight Java-based XML parser designed to run on limited, embedded systems such as personal mobile devices. It is a pull parser which means it reads a little bit of the document at once. kXML 2 implements the XML Full Parser API. It should be used when all the process has to be performed quickly and efficiently to input elements. We can say kXML is the J2ME Parser. The architecture of kXML parser and processing is shown in fig. 7.

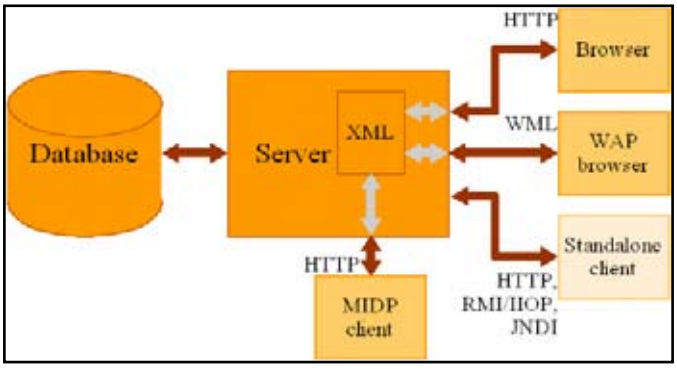

Fig. 7: XML Parsing Architecture

D. Database Interaction in Mobile Devices

Because of the device space and other constraints it's not possible to establish conventional database connectivity, so we need to go for another alternative, the foremost familiar method is using mimer SQL in Midlets, Mimer is an advanced database management system. The Mimer MIDP driver should be used in environments supporting the CLDC/MID Profile specification. It is a strict subset of the regular JDBC for CDC configurations API [8]. Also applications developed with Mimer MIDP will run with little change in a regular JDBC environment and vice versa. Programming skills obtained using regular JDBC programming may be applied to programming within the MIDP environment as well. The entire architecture is depicted in the fig. 8.

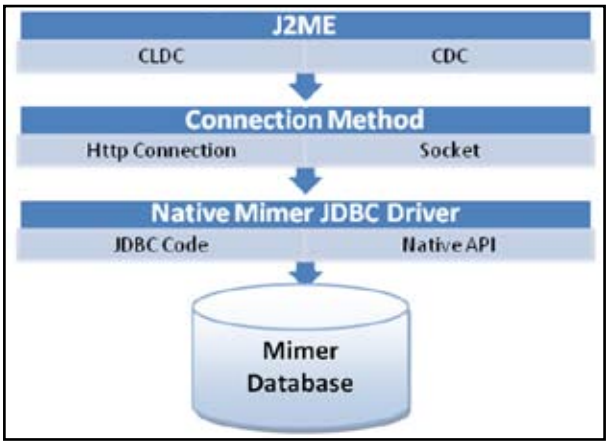

Fig. 8:

E. Fuzzy Constrained Search Method

Fuzzy logic is a form of many-valued logic; it deals with reasoning that is rough rather than fixed and exact. In contrast with conventional logic theory, where binary sets have two-valued logic: true or false, fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. As we introduced the keyword in abstract, The Fuzzy mode is much suitable for the user who already knows fuzzy logic and fuzzy set. Thus in this mode, we provide a simple search method. The system will first obtain the user's current location and show the name of the current city The search engine will take this city as the default search location. And based on users location it tries to find the relatively nearest information from the database. Suppose we want to shop for shoes, our purchase limit is say Rs.1500/- in this case it's always not possible to get exactly products whose price Rs. 1500/-, the search should be relatively nearer to the actual value that means the results would be greater or less than actual value with a price variant difference with 15%.

F. Obtaining Today's News

Getting updated news from web is a stylish feature in this proposed system. This can be achieved with the help of RSS Feeds from web. RSS (Rich Site Summary) is a format for delivering frequently changing web content. Many news-related sites, weblogs and other online publishers organization their content as an RSS Feed to whoever wants it. RSS solves a problem for people who regularly use the web. It allows you to easily stay informed by retrieving the latest content from the sites you are interested in. You save time by not needing to visit each site individually.

RSS feeds can be interpreting using software called an "RSS reader", "feed reader", or "aggregator", which can be web-based, desktop-based, or mobile-device-based. The user subscribes to a feed by entering into the reader the feed's URI or by clicking a feed icon in a web browser that initiates the subscription process. The RSS reader checks the user's subscribed feeds regularly for new work, downloads any updates that it finds, and provides a user interface to monitor and read the feeds. RSS allows users to avoid manually inspecting all of the websites they are interested in, and instead subscribe to websites such that all new content is pushed onto their browsers when it becomes available.

There are several different versions of RSS, falling into two major branches: RSS 0.90 was the original Netscape RSS version, RSS 1.0 is an open format by the RSS-DEV Working Group, again standing for RDF Site Summary.RSS 1.1 is also an open format and is intended to update and replace RSS 1.0. RSS 0.91 is the simplified RSS version released by Netscape, and also the version number of the simplified version originally championed by Dave Winer from User-land Software.

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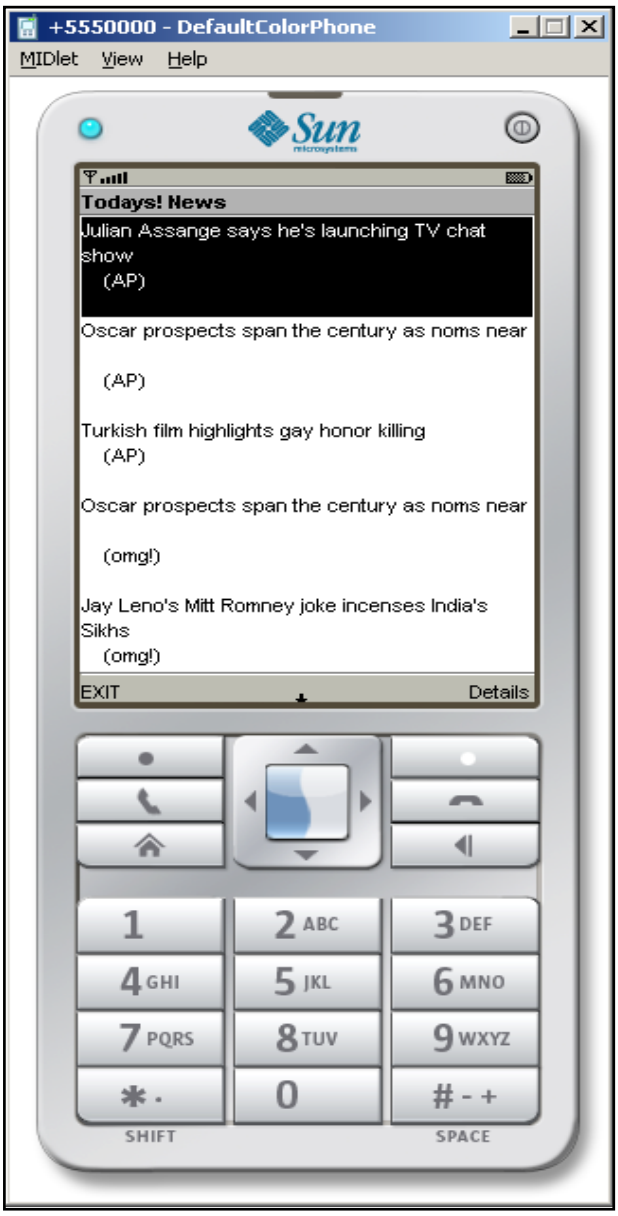

Fig. 9: Obtaining Today's News Updates

G. Hotels Search and Reservations

"Hotel Search and Reserve is a win-win solution for consumers who want a wide choice and the best prices and for independent hotel, guesthouse and B&B owners who get increased online visibility at no cost. The hotel search market has always been competitive but new entrants are appearing more rapidly than ever before. The vast majority of small hotels save their best rates for their own websites and are not listed on the big travel agents like Expedia.

Fig. 10: RSS Feeds Working Structure

In our system we are proposing Hotels search, booking and status knowing and other primary level features which are very helpful to the customers those who are new to the particular location or area. This will improve the effective usage of modern trendy mobiles and E-commerce applications in mobile devices. This can be achieved with the help of Mimer Database it's an RDBMS application and very light weight application. As compared to Oracle it will gives and effectives performance in terms of portability, mobility in CLDC application perspective.

V. Conclusion

This paper implements a Geographical Information retrieval system for mobiles. In this application we propose a series of parsing techniques that can be used to extract data from web. This paper strives to capture the current developments in Information Retrieval based on Location; we have also seen a series of issues and challenges imposed on LBS research from both technological and societal perspectives.

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